Water: a looming crisis?

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WATER IN THE HUNGRY, POOR, AND URBANIZING WORLD —A FOCUS ON UNCERTAINTY AND INTERDISCIPLINARITY

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ABSTRACT

There has been a boom of global assessments and summit meetings—targeting on global key natural resources, population and other social issues, and on economic questions—in the last few years. They have set a new basis for our knowledge on the evolution of the globe's state. However, there is space for many developments and improvements. We discuss the crucial roles of uncertainty and interdisciplinarity, which are by now understated. Water is deeply interconnected with issues such as food production, poverty, and urbanization, and without such interconnections, analyses cannot provide all the needed and all potential support to policy makers. The crucial role of these issues should be fully appreciated in water resources assessments, and water should be fully recognized in assessments concerning them.

KEYWORDS

Food security, globalization, interdisciplinarity, poverty, uncertainty, urbanization, water availability

INTRODUCTION

Recent years have seen a spectrum of global summits and comprehensive assessments targeted to set light to possible development pathways on many key issues constraining or facilitating the development of nations and the mankind. These issues include water, food, population, urbanization, various environmental and social aspects, and many more. The tendency of growing concern of our future, with wide-ranging international contributions to put together and expand the knowledge of these issues is a highly welcomed one. The water sector has recently seen a number of highly qualified assessments (e.g., Kulshreshtha 1993, Shiklomanov 1993, SEI 1997). They have set a new standard and basis on discussions of global water-related issues.

However, there is still a plenty of room for development of these assessments. We argue that they generally suffer from far higher inaccuracies and uncertainties than the reports themselves reveal. This can simply be seen when comparing assessments with one another. Moreover, there is still a plenty of room for increasing their interdisciplinarity, and integration with one another. Such features are mandatory in order to increase their applicability in policy advice and analysis. The importance of global studies is unarguable, but there are still major challenges, which partly are related to approaches and methodologies used.

This paper discusses these issues starting from the most important cross-sectorial interconnections of water at the global level: food, poverty, and urbanization. Thereafter, some examples are taken from global assessments to discuss their uncertainties and ambiguities. The huge disparities in today's world—with respect to population, urbanization, economic potential, access to natural resources and food, and in capabilities to influence global decision-making—are demonstrated before the conclusions. A more comprehensive analysis along these lines is presented elsewhere by Vakkilainen & Varis (1998).

WATER DEVELOPMENT IS LINKED TO FOOD, POVERTY AND URBANIZATION

For balanced water resources development, it is not enough that there is water available. The supply should meet the demand, but this cannot be realized without the appropriate capacity—including human, institutional, technological, and economic—to put the resource in use. This all should be managed so that the resource itself is not damaged, i.e., in a sustainable way (Fig. 1). In practice, the sustainability concept includes, besides the ecological dimension, also economic, social, and political aspects.

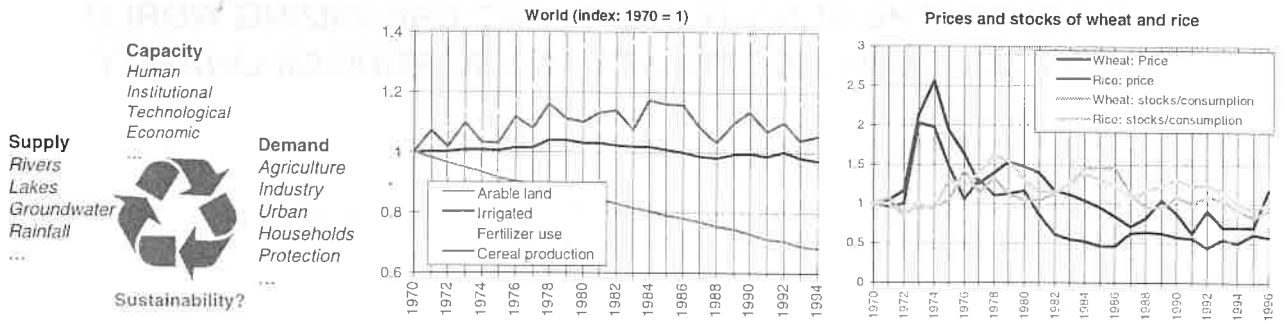

Fig. 1: *Left:* Supply, demand, capacity, and sustainability: the challenges to meet the water demand are tough enough without the unavoidable quest for sustainability (Varis 1997). *Center and right:* Who will invest on food production? The per capita indexed development of arable land, irrigated land, fertilizer use, cereal production, cereal prices, and cereal stocks (data: World Bank 1997).

Over 2/3 of all water withdrawals go for food production. Around 16% of world's arable land is under irrigation, and those fields produce 1/3 of all agricultural output (Postel et al. 1993). The crucial role of water as an agricultural input, and as a major factor in the rapidly grown food production in 1970-1990, is unarguable. The arable land area did not grow in that period, but the irrigated area went up 40%. In conjunction with the developments in the application of other inputs, the world's grain production grew with 72%. This yielded a notable improvement in the global food situation, because the population growth did not exceed 40%. This positive development trend has been replaced by a more stagnant one in this decade. Both the arable land area and the fertilizer application rate have decreased. The irrigated area grows still, but much more slowly than before. As a consequence, food production has not grown, whereas population has with 14%, with 720 millions. This trend has evoked wide concern in various directions recently, because much of the achievements of the past decades has already been lost; the per capita grain production has returned to the mid 1970 level (Fig. 1).

There must be several reasons to this development shift. One (both ways) is the rapid urbanization development (Fig. 2); roughly 80% of all population growth ends to urban areas. Many developing countries witness a strong political priority to urban development over rural one. Accordingly, it has been estimated, that whereas today roughly 1/2 of the global population is still rural, in 2025 that share will only be 1/3. Yet, it is mainly the rural population that feeds also the urban dwellers. One reason is the collapse of centrally planned economies, with highly input-intensive agriculture. Partly as a consequence of the collapse, the free trade paradigm has been prevalent, forcing agricultural investments to compete more with other investments (manufacturing industry, urban services, tourism), on the basis of revenues per invested sum of money.

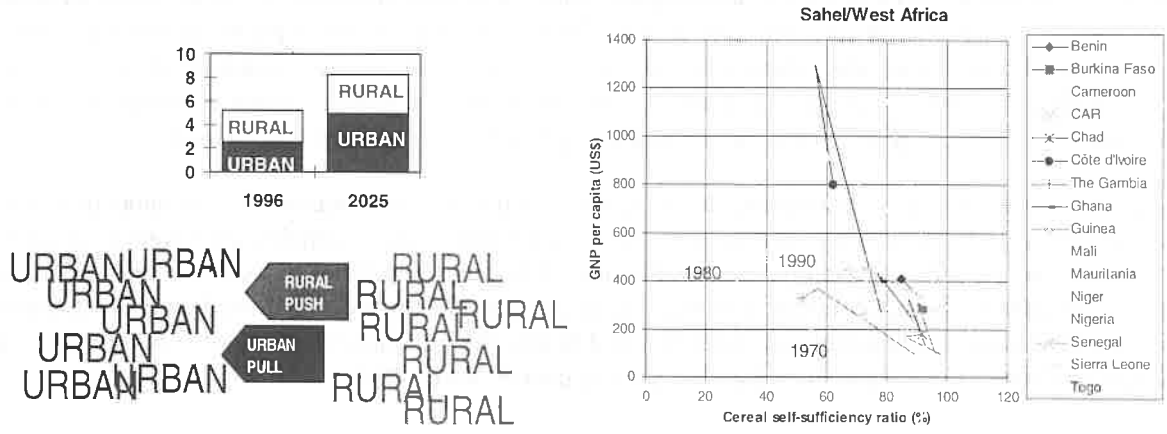

Fig. 2: *Left:* the world's urban population will double till 2025, but rural population stays almost unchanged (Varis 1997; data: UN 1994). *Right:* The poor countries in Sahel/W Africa are able to import food once they have money for it (data: GNP: World Bank 1997, self sufficiency: Alexandratos 1995).

Water is a basic need in many ways; as drinking water, in sanitation, in public health, in food production. In economic development its role is crucial: most developing countries depend on local food supplies and export income from agricultural products to allow import of manufactured goods and primary products they

cannot produce themselves. Globally, food availability and security are among the mankind's major threats. The expansion of agricultural production has to take place, and the food must be produced somewhere. The individuals that suffer most from food and water scarcity tend to have the weakest voices in local and global policy-making. Typically, the successful export of foodstuffs from a low-income country hits worst back to the domestic poor whose food becomes less accessible to themselves, given their lacking cash. Foreign trade benefits go to others. This brings in mind the fairness issue of global trade liberalization, advocated by rich, highly urbanized economies such as USA, EU, and Japan. From the world market, Japan alone imports 4 times the amount of grain than the whole Sub-Saharan Africa (Alexandratos 1995). Is it because there is no demand for food there? Demand certainly exists; the per capita calorie consumption in Sub-Saharan Africa is only around 60% of that in developed countries. They simply do not have enough cash (Fig. 2). Similarly, many other sub-sectors of water development are heavily constrained by human, institutional, economic, and technological capacities (Varis & Somlyódy 1997), and hinder the development of the societies as a whole.

DRIVING FACTORS TO DEVELOPMENT ARE HIGHLY UNCERTAIN AND UNSTABLE

It is definitely an anecdote to say that the future of the mankind is governed by various uncertainties. However, this fact does not seem to be properly acknowledged in today's global change and development studies. It is a commonplace to present a 'forecast', which gives a single value for the item in concern, given a specific time slot in the future. Another approach is to present a set of scenarios, e.g., low, medium, and high ones, with varying assumptions of some critical parameters in the model used.

It is, however, crucial to fully appreciate the complexity of global-scale issues, and their deeply interwoven interconnections. We demonstrate the inaccuracies of global assessments with two examples (Fig. 3); water and food availabilities in the world. Depending on the study approach, data used, and other factors, different people end up to very diverse views on the state of these issues now and in the future.

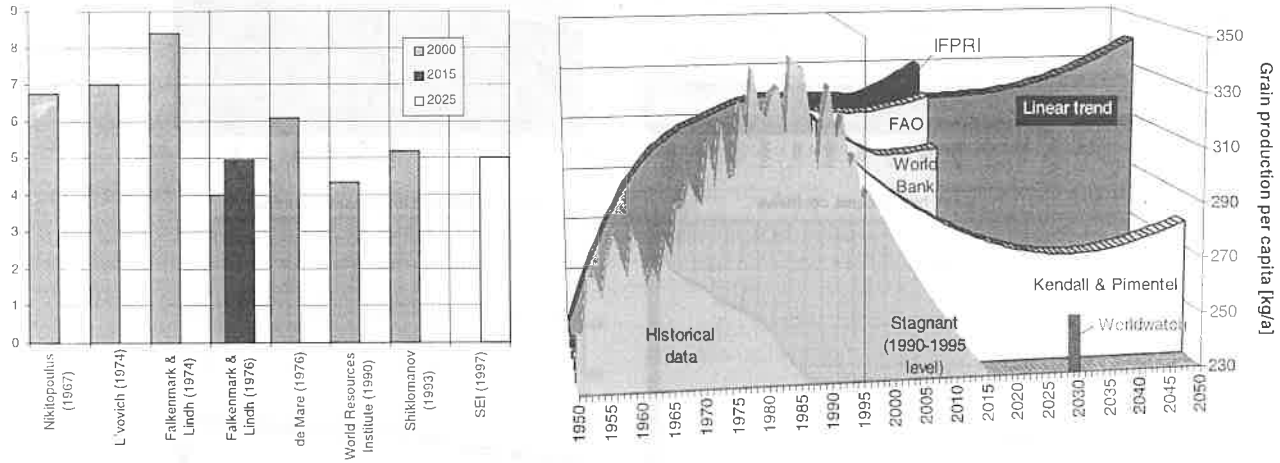

Fig. 3: Water withdrawal (*left*; SEI 1997; unit: 1000 km^3/a) and food (*right*) projections are highly uncertain, showing notable mismatches. The food projections are IFPRI (Agcaoili & Rosegrant 1995), FAO (Alexandratos 1995), World Bank (Mitchell & Ingco 1993), Kendall & Pimentel (1994), and Worldwatch (Brown 1996).

We cannot avoid the thought and the overall feeling, that the studies—or perhaps rather the approaches used—tend to overlook the various interconnections and uncertainties, and give therefore an overly deterministic view of development of very complex issues. The world itself is subject to high uncertainties and unpredictable variations. This applies not only to natural resources such as water, land and food, but also to the nature itself, to the development of economies, and that of the whole human societies. The climatic change projections show locally and globally huge mismatches, and *the most important signal for policy makers is simply the increased uncertainty* (Varis & Somlyódy 1996). Other environment-related issues such as land degradation, increased pollution, the loss of forests and biodiversity share many of these same features.

When considering the economy, the highly unstable development wittnessed by numerous countries immediately influences the pressure set to natural resources, but is not properly included in global assessments. E.g., in the IPCC and World Bank scenarios for GDP used by SEI (1997), for S and SE Asia, the annual growth rate used was 4.5%. Now, a few months later, the rupee has gone down with over 80% of its value at

that occasion, which was not long ago in comparison to the time frame of the study itself: till 2025. Indonesia with its over 200 million people is not alone. Most SE Asia, with many other Asian, African, and Latin American countries suffer from similar instabilities, that are reflected throughout today's globalizing world.

What comes to political uncertainties, it is still easy to recall the development in former centrally planned economies in Europe and some other continents. The developments in the last 10 years were highly impredictable, and affected deeply the global economy. Many other examples can be given. In the countries that lie in the basin of the Nile, only Egypt has not been suffering from major political instabilities or civil wars during the past 25 years. The others have each appeared on TV-screens due to sad reasons. In fact, political instabilities have been rather a rule than an exception in many parts of the world that are most affected by the developments that will become effective in the global water, food, poverty, and urbanization arena.

UNDERLYING DISPARITIES FEED THE INSTABILITY

The world is rich with contrasts and disparities with respect to aspects discussed in this paper. Clear is it, though they present such a magnitude, appearance, and character, that they deserve a special concern. We have collected some examples including economic capacity and population in rural and urban areas (Fig. 4), urbanization rates (Fig. 5), and water use vs. availability (Fig. 6). They destabilize the world development in a number of ways. In addition, they constitute deep-going problems of equity within the mankind, with respect to access of the basic needs such as water, food, housing, education, and good livelihood.

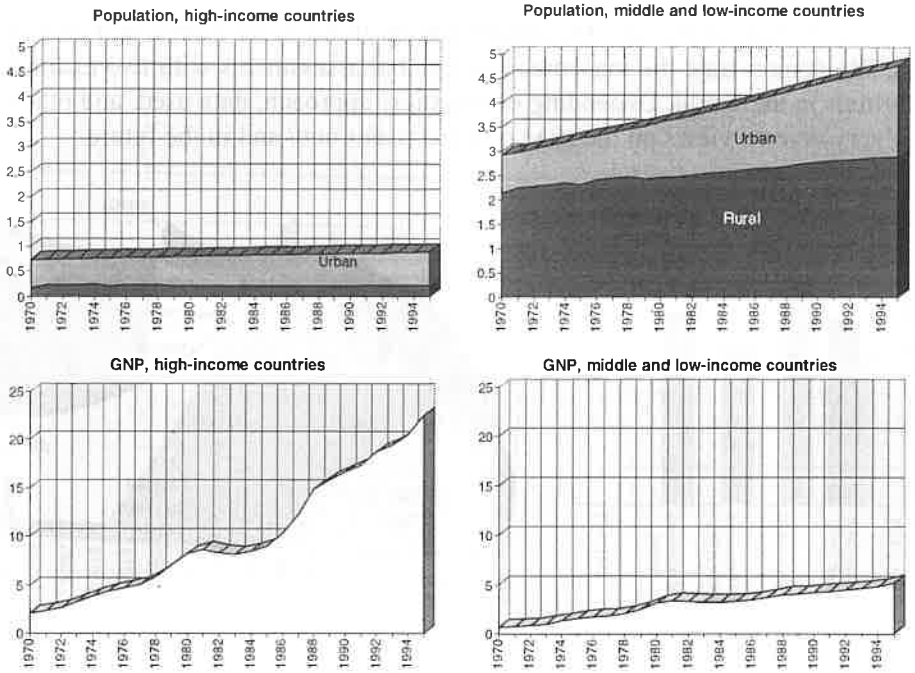

Fig. 4: The high-income, mainly urban, people do not put their money to agriculture of developing countries. Most cash in developing countries is in urban hands (data: World Bank 1997). GNP unit is US$ 10^{12} per year.

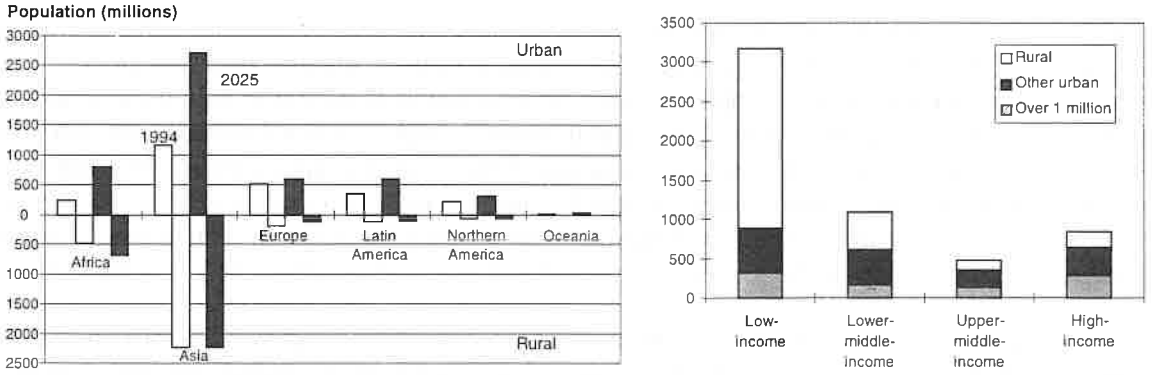

Fig. 5: Urbanization will be fastest in Africa and Asia (*left*; data from UN 1994). The rates are the highest in the poorest countries. In 1990-94, they were 3.8% for low-income, 2.3% for lower-middle, 2.6% for higher-middle, and 0.3% for high-income economies (*right*; data from World Bank 1996).

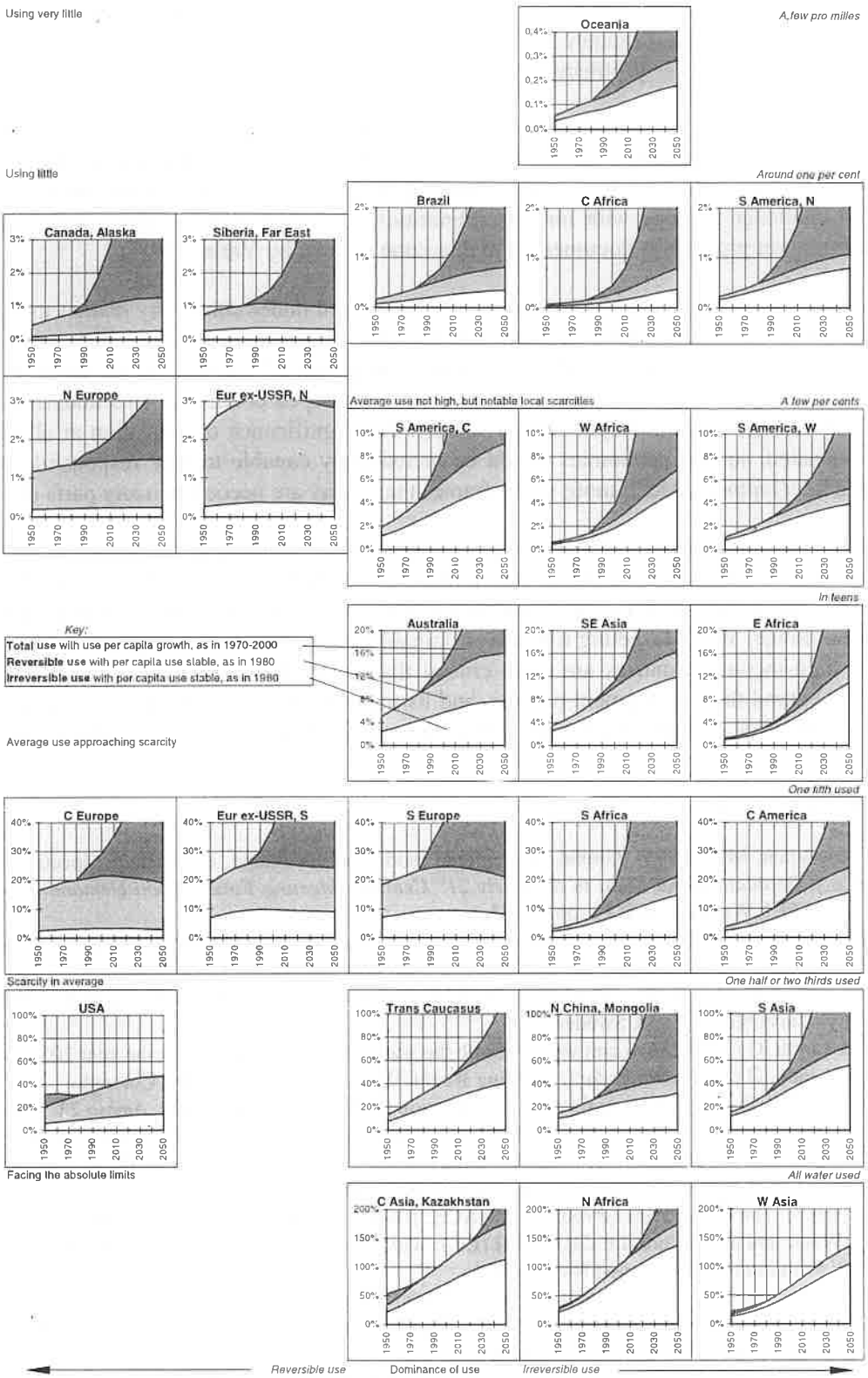

Fig. 6: Growth of water use related to availability. Based on regionalized data and assessments by Shiklomanov (1993). Water use data is from 1980, 1990, and 2000, and water availability data from 1950, 1960, 1970, 1980, and 2000. Other values extrapolated. It can easily be seen, that simple assumptions in one parameter (per capita water use) lead to drastically different outcomes in the analysis.

CONCLUSIONS

The study underlines the importance of various uncertainties in the global assessments of water, food, population, economy, and social issues. There exists very diverse views on the present state of the world's resources, and the future projections are subject to notable mismatches. Political instability and unpredictability, hydrologic and climatic variations and their likely shifts from the observed behavior, economic de-

velopment, ecological and environmental threats including land and watershed degradation being the foremost issues. The basic message is though clear: there is a rapidly growing pressure to natural resources, and the time constraint to tackle these problems is tough.

There should be more focus on real interdisciplinarity and integration in global assessments. Water should be considered in closer connection with social, economic, financial, environmental, political, and institutional issues to bring the analyses closer to policy making. Comparative, cross-sectorial works are needed. A methodological challenge to cope with interdisciplinarities and extreme uncertainties and complexities is evident. One attempt in progress is documented in this same volume by Varis (1998).

Water and food are too precious and basic issues to be forwarded under control by market mechanisms and business cycles only. The poorest 85% account only for 18% of global cash flows. They are not equitable partners in the world market. A major stabilizing factor is to produce food close to the users, by not forgetting the self-sufficiency paradigm, both in developing and developed countries. This underlines the many-sided, stabilizing role of rural development in a society. The significance of education at all levels should not be underestimated, so that economies would be increasingly capable to take responsible care of their own sustainable development. Much more stable frames than today are needed in many parts of the world.

Most of the negative consequences of unbalanced and unstable development are felt by developing countries; by the poor and hungry. From there, they reflect increasingly over the whole globe. In the rapidly globalizing world, the responsibility of industrialized countries is growing as the economies get more open and trade barriers lower. When targeting towards sustainable and equitable development at the global level, the policies in high-income countries are more crucial than many think. Water has many very basic and deep-going roles behind the development process, and its many facets should be appreciated and realized in development co-operation policies of developed countries, and in the policies of international organizations.

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